

***Vaccinium venosum* Wight (*Ericaceae*) Rediscovered from Arunachal Pradesh, India**

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Vaccinium venosum Wight has been rediscovered from Lohit District, Arunachal Pradesh, NE India, after a lapse of seventy-five years. The species is provided with detailed description, citation, types, distribution map, illustration and note on its stomata, leaf-areoles and pollen.

Key words: Arunachal Pradesh, India, leaf-areoles, pollen, rediscovery, stomata, *Vaccinium venosum*.

The genus *Vaccinium* L. consisting of about 140 species (Mabberley 2008), is distributed in tropical Asia, Europe, South-eastern Africa, Madagascar and America. Of these, 28 species are reported to occur in India by Panda and Sanjappa (2007), Panda (2008) and are distributed in Eastern Himalaya, North-eastern India (except Tripura) and hill tops of South-western Ghats.

During the field studies conducted in Lohit District of Arunachal Pradesh, India, in April 2003, an interesting specimen of *Vaccinium* was collected near Udayak Pass on the way to Hayuliang from Tezu at an altitude of ca. 1500 m. This was identified as *Vaccinium venosum* Wight.

Vaccinium venosum Wight was first collected by William Griffith from Bhutan Himalaya (neither field number nor date of collection mentioned on the type specimen) and described by Robert Wight (1847). Subsequently the species

was collected by Griffith from Arunachal Pradesh (Kew distribution no. 3461), J. D. Hooker from Meghalaya (Sleumer 1941), I. H. Burkill (nos. 36349, 38200, CAL) from Arunachal Pradesh in 1912 and F. Kingdon-Ward (no. 7973, BM) from Dalai Valley (“Delei Valley”) of the present Anjaw District (formerly part of Lohit District) in Arunachal Pradesh in 1928. Since then (after Kingdon-Ward 1928) several field trips were undertaken in these areas but this species could not be located. After Griffith no further collections were made from Bhutan (Rae 1991). This species is also reported from Xizang, China by Ruizheng and Stevens (2005) based on old herbarium materials but without detailed investigation. No further collections were also made so far from China. Hence the present report is of special significance. The population of this species in Arunachal Pradesh, India, was very rare in distribution and was represented by only two plants.

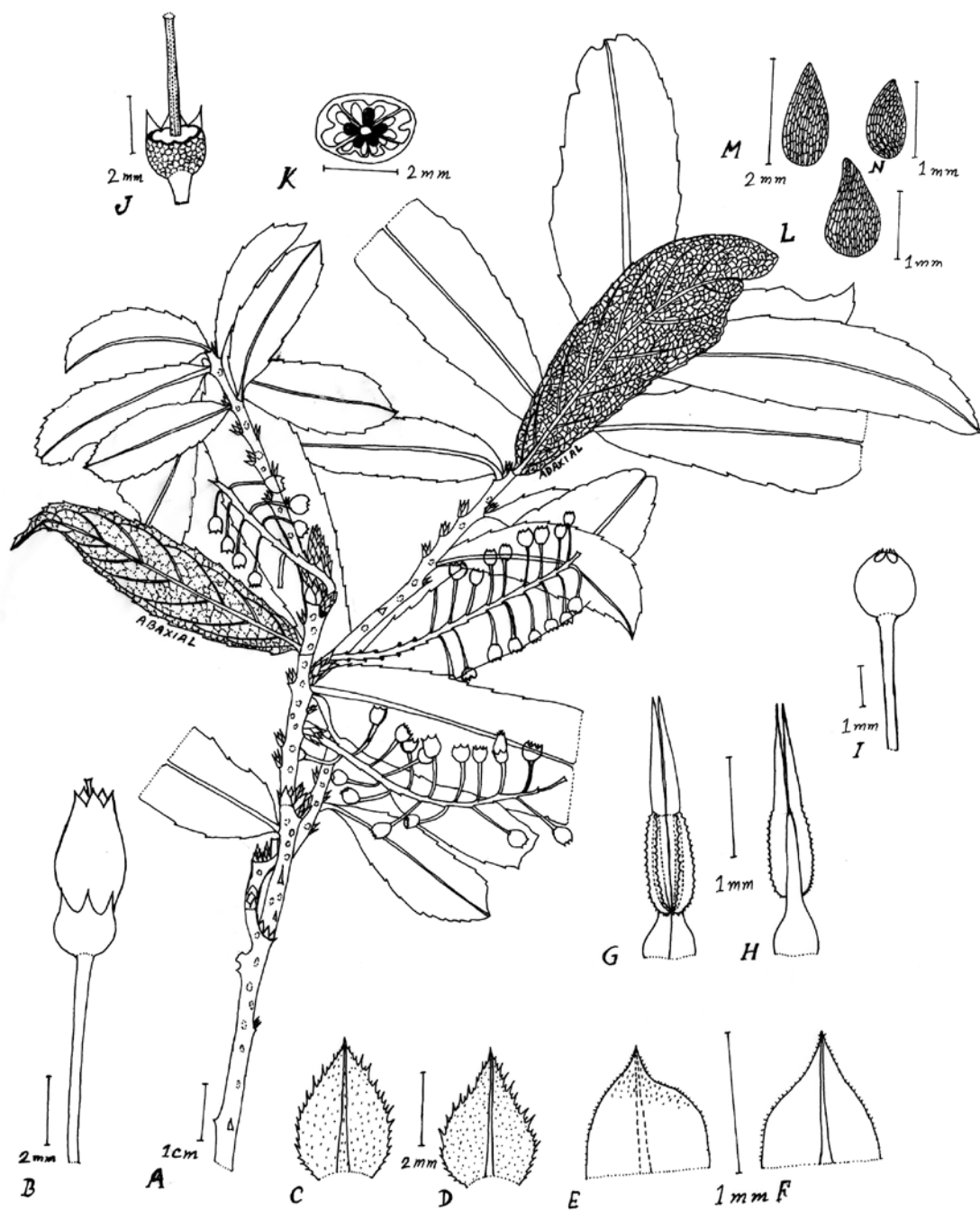


Fig. 1. *Vaccinium venosum* Wight from Arunachal Pradesh, India. A. Habit. B. Flower. C–D. Pedicellar bract (dorsal and ventral). E–F. Calyx-lobe (dorsal and ventral). G–H. Stamen. I. Fruit. J. Pistil. K. Ovary (t. s.). L–N. Seed. Drawn from S. Panda 30877 (CAL).



Fig. 2. Habit of *Vaccinium venosum* Wight from Arunachal Pradesh, India.

Taxonomic account

Vaccinium venosum Wight in Calcutta J. Nat. Hist. **8**: 172 (1847); Icon. pl. Ind. Orient. **4**: t. 1185 (1848) – C. B. Clarke in Hook. f., Fl. Brit. India **3**: 452 (1882) – Kanjilal & al., Fl. Assam **3**: 142 (1939) – Sleumer in Bot. Jahrb. Syst. **71**: 477 (1941) – *Epigynium venosum* (Wight) Klotzsch in Linnaea **24**: 50. 1851. **Type**: BHUTAN. Griffith s.n. (K, photo!). [Figs. 1–4]

Stout, erect shrub, 0.5–1 m high, often epiphytic on old tree trunks, rarely on rock crevices. Stem profusely branched, glabrous; branches and twigs terete to angular, lenticillate, glabrous rarely covered with lanceolate scales up to 7 mm long. Leaves alternate, lamina elliptic-oblong, elliptic-lanceolate to oblong-lanceolate, (3–)5–10 × 1.5–3 cm, serrate to crenate-serrate at margin, narrowly cuneate to slightly rounded at base, acute to acuminate at apex, glabrous or setulose along midvein above, glabrous beneath; venation conspicuous brochidodromous with 10–12 pairs lateral veins; petioles (1–)4 mm long. Racemes axillary or pseudoterminal, perulate; rachis light green, 3–7 cm long, 12–25-flowered,

glabrous. Flowers 10–12 mm long; pedicels light green, 5–7 mm long, glabrous; bract 1, basal, caducous, elliptic to ovate-elliptic, ca. 2 × 1 mm, ciliate at margin, apiculate at apex, glabrous; bracteoles 2, opposite, subbasal, caducous, linear, ca. 1.5 × 0.5 mm, ciliate at margin, acuminate at apex, glabrous. Calyx lobes narrowly to broadly ovate-triangular, ca. 1 × 0.5 mm, entire or ciliolate at margin, acute at apex, glabrous or puberulous inside. Corolla ovoid-urceolate, greenish-white, 4–5 mm long, 2–3 mm diameter, glabrous, lobes ovate-deltoid, minute. Stamens 10, 3–4.5 mm long; filaments greyish-white, (0.5–)1.5 mm long, slender, glabrous, dilated at base; anthers orange brown, oblong, 1–1.5 mm long, granular, each lobe with ca. 1.5 mm long single tubule. Pistil 5–6 mm long; ovary globose, light green, 1–2 × 1.5–2 mm, glabrous, ovules 6–8 on axile placenta in each locule; disc minutely 10-dentate; style light green, ca. 4 mm long, slender, glabrous; stigma truncate. Fruit a globose berry, light green, ca. 4 × 4 mm with ca. 8 mm long pedicel, glabrous. Seeds 20–30, yellowish-brown, obconical, 0.8–2

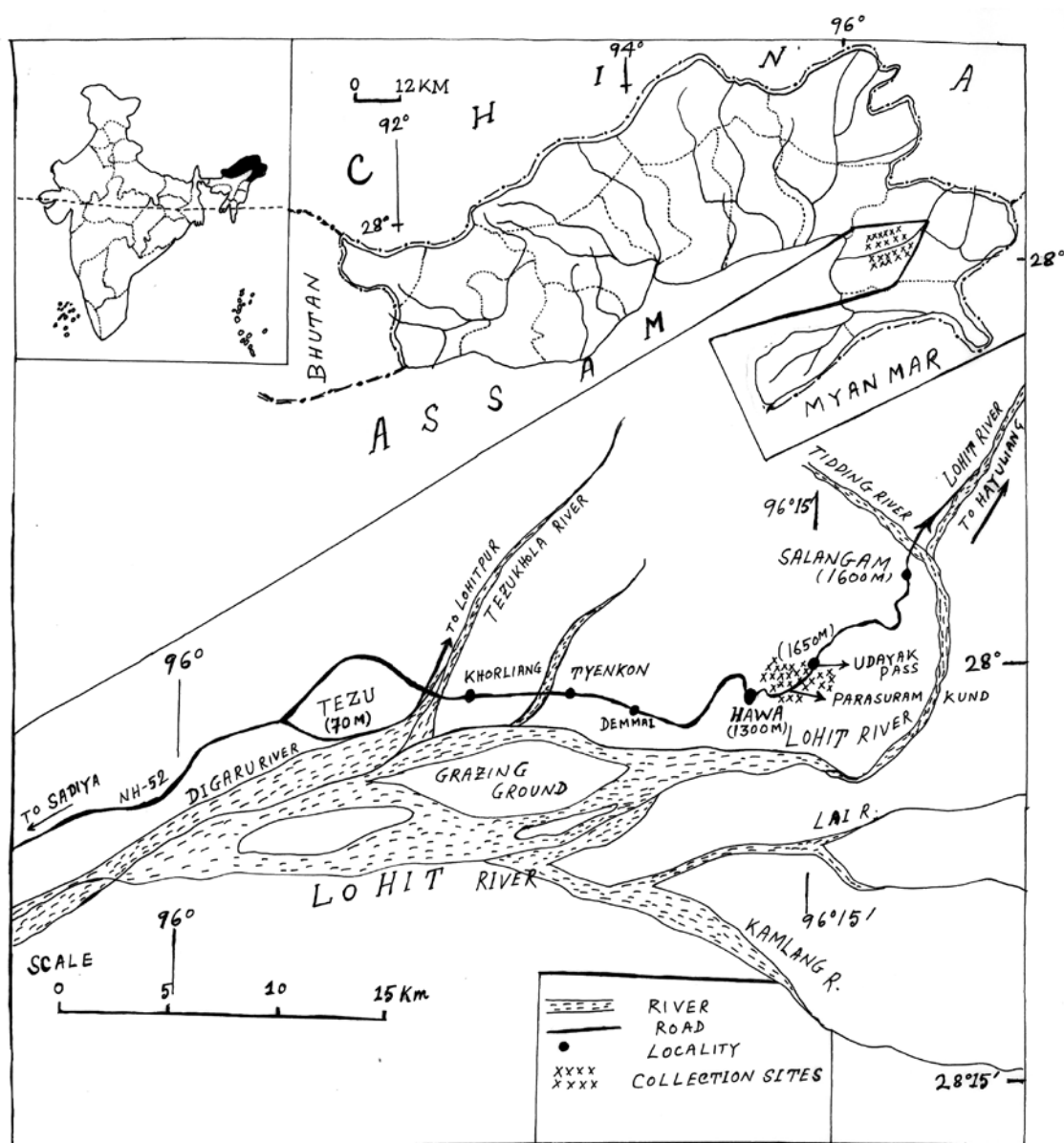


Fig. 3. Distribution of *Vaccinium venosum* Wight in India.

mm long, scariose.

Distribution: India: Eastern Himalaya (Arunachal Pradesh) and North-Eastern India (Meghalaya?) (Fig. 3). Bhutan and SW China.

Habitat: This species is extremely rare and threatened grows on moist and dry rocky slopes in association with *Lyonia ovalifolia* at an altitude of ca. 1500 m.

Flowering: February to April.

Fruiting: Late April to August.

Specimens examined: INDIA. Arunachal Pradesh, East Siang district: above upper Rotung, 4500 ft, 3 Mar. 1912, I. H. Burkill 38200 (CAL); summit between Serpo and Lalik, 5000 ft, 28 Jan. 1912, I. H. Burkill 36349 (CAL). Lohit District: Hawa Camp to Salangam, near Udayak Pass, 1500 m, 24 Apr. 2003, S. Panda 30877 (CAL).

Notes: *Vaccinium venosum* was recorded

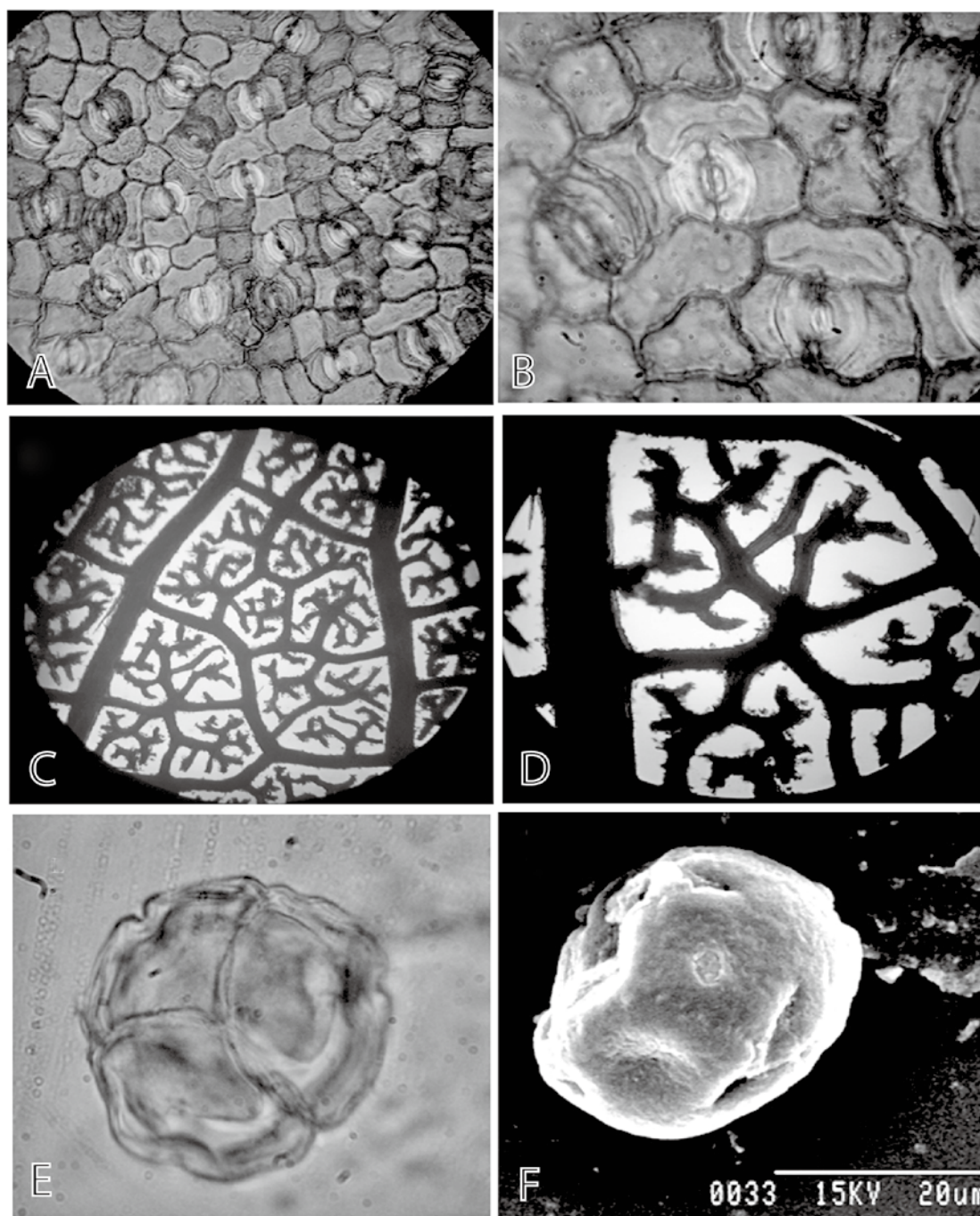


Fig. 4. *Vaccinium venosum* Wight from Arunachal Pradesh, India. A–B. Stomata. A. $\times 40$. B. $\times 100$. C–D. Leaf areole. C. $\times 25$. D. $\times 100$. E–F. Pollen grain. E. $\times 100$ (LEM). F. $\times 600$ (SEM).

from Khasia Mountains, Meghalaya, by C. B. Clarke (1882) and Sleumer (1941) based on W. Griffith and J. D. Hooker's collections (K). The

same species was also described by Kanjilal et al. (1939) from Khasi Hills but they did not cite any collection and no specimens of this species

found at ASSAM (where collections of Kanjilal et al. are deposited). Specimens of this species from Meghalaya were also untraceable in other Indian herbaria (APFH, BSHC, BSD, BSIS, CAL, DD and MH). Therefore, distribution of Meghalaya is given here based on the literatures (Clarke 1882, Sleumer 1941). The populations of Arunachal Pradesh (S. Panda 30877, CAL) showed puberulous calyx lobes and bracts, minute filaments (ca. 0.5 mm long) and green berries not reported earlier.

Leaf and pollen morphology

Stomatal slide preparation

Small cubical pieces of leaf blades (ca. 1 cm²) were excised from the base, middle and apex. Several existing methods viz., 10% HNO₃-boiling for 10 minutes, 5% KOH overnight (12–24 hours) treatment without boiling and with boiling were done. Pieces were ringed in sterilized water until clear. After clearing, pieces were dehydrated in an ethanol series followed by staining with 10% safranin and mounted onto a microscope slide in DPX (pieces of basal, middle and apical regions on one slide). The slide was examined under an Olympus (Tokyo) light microscope using 10 \times , 45 \times and 100 \times objectives and Camera Lucida drawings were made with the help of drawing prism. The slide is deposited in the laboratory of Taxonomy & Biosystematics, Post Graduate Department of Botany, Barasat Government College, Calcutta University. The descriptive terminology follows Metcalfe and Chalk (1950), Dilcher (1974), Stace (1965, 1989), Fahn (1997), Carpenter (2005) and Judd et al. (2008).

Methodology of leaf clearing for venation study (areoles)

Entire mature leaves were immersed in 2.5% NaOH solution until clear (closed condition). In the present study, most of the leaves were cleared after 15 days of NaOH treatment. After 15 days, these NaOH-treated leaf samples were again immersed in 2.5% NaOH solution for 2–3 days

followed by 1 drop chloral hydrate treatment overnight. Leaf samples were then washed in distilled water. After clearing, one good sample (entire leaf) was dehydrated in an ethanol series followed by staining with 1% safranin and mounted onto microscope slide in DPX (entire leaf in one slide). The slide is deposited in the laboratory of Taxonomy & Biosystematics, PG. Department of Botany, Barasat Government College (Calcutta University). The descriptive terminology follows Hickey (1973) and Dilcher (1974).

Preparation of pollen slide

The method used in this study followed Erdtman (1952, 1969, 1986) and Sarwar et al. (2006). The slide is deposited in the laboratory of Taxonomy & Biosystematics, PG Department of Botany, Barasat Government College, Calcutta University.

Slide preparation for SEM

Acetolysed pollen grains were mounted on the metallic stub using double sided sticky tape. Observations were made with Hitachi S530 (SEM, Tokyo) in the high vacuum mode at an applied voltage of 15 KV.

Stomata (Figs. 4A, 4B)

The study of Light Microscopic stomatal architecture (40 \times , 100 \times) includes number, form and arrangement of specialized epidermal cells associated with the stomatal guard cells. Stomata are distributed more or less evenly over the entire abaxial leaf surface in between the veins, but generally not over the finer veins and main veins. The stomata are uniformly distributed on the abaxial surface only, they are widely separated from each other by epidermal cells.

Stomata type

The investigated species shows only one type, paracytic. Average dimension of stomata is 21.6 \times 21.2 μ m. Average dimension of guard cells: 15.3 \times 2.4 μ m. Epidermal cells are mostly

polygonal and isodiametric, some are elongated to deltoid. The epidermal walls in surface view are slightly arched to rarely straight. The epidermal walls in the adaxial surface are mostly straight. The maximum length of epidermal cell is 51.2 μm and breadth is 19.8 μm , while minimum length is 19.2 μm and breadth is 11.4 μm .

Leaf areoles (vein islets) (Figs. 4C, 4D)

Pentagonal, hexagonal to rarely triangular in shape. Larger areole: 459 \times 328 μm . Smaller areole: 302 \times 205 μm . Areoles: 6 (average) per 1 mm^2 . Vein endings: 78 (average) per 1 mm^2 ; veinlets simple unbranched to branched (once). Branched and unbranched veinlets occur in the same areole. Vein ends: pointed to bulbous.

Pollen morphology (Figs. 4E, 4F)

Pollen grains occur in tetrahedral tetrads, 3-zonocolporate. Tetrad size (D): 42.5–46 μm diameter. Individual grain size (d) variable, 17–26 μm diameter. Individual grain possesses distinct slender transverse furrows. Exine tectate, ca. 2.8 μm thick, surface faintly rugulate-psilate. $D/d = 2.05$. Colpi distinct, 4.8–9.8 μm long, 0.9–1.3 μm wide. Ratio of colpus length (2f) to tetrad diameter (2f/D), 0.11–0.43 μm , colpus margin distinct, acute to tapering towards ends. Septum thickness 1.7–3.4 μm .

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S. パンダ^{a,*}, M. サンジャツパ: インド, アルナチャル・ブラデシュ州から再発見された絶滅危惧植物, *Vaccinium venosum* Wight (ツツジ科)

Vaccinium venosum Wight はブータンから記載されたツツジ科スノキ属の灌木である。インドでは東北部のアルナチャル・ブラデシュ州で 1928 年に得られたことがあるが、それから 75 年後の 2003 年に同州で再確認することができた。ここではインド産の材料にもとづいて、本種の再記載を行った。また、これまでに報告されたことのなかった、

気孔、葉の areole、花粉粒についての観察結果を詳しく述べた。本種は標高約 1500 m の岩勝ちの斜面に生育し、樹木や岩場に着生する。現地では個体数が極めて少なく、絶滅危惧植物の一つと考えられる。

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